UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northwest Region
7600 Sand Point Way N.E., Bldg. 1
BIN C15700
Seattle, WA 98115-0070

Refer to:
OHB2002-0049-FEC

March 13, 2002

Mr. Denis Williamson
Salem District Manager
U.S. Bureau of Land Management
1717 Fabry Road
Salem, Oregon 97306

Re: Endangered Species Act Formal Section 7 Consultation and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation, Horning Seed Orchard Year 2002 Insecticide Application, Bureau of Land Management Salem District, Cascade Resource Area, Clackamas River Basin, Clackamas County, Oregon

Dear Mr. Williamson:

Enclosed is a biological opinion (Opinion) prepared by the National Marine Fisheries Service (NMFS) pursuant to section 7 of the Endangered Species Act (ESA) for insecticide (Esfenvalerate – Asana XL) application in 2002 at the Walter Horning Seed Orchard, Clackamas County, Oregon. NMFS concludes in this Opinion that the proposed action is not likely to jeopardize Lower Columbia River steelhead (*Oncorhynchus mykiss*) or destroy or adversely modify their critical habitat. Pursuant to section 7 of the ESA, NMFS has included reasonable and prudent measures with non-discretionary terms and conditions that NMFS believes are necessary and appropriate to minimize the potential for incidental take associated with this project.

This Opinion also serves as consultation on essential fish habitat for coho salmon (*O. kisutch*) and chinook salmon (*O. tshawytscha*) pursuant to section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act and its implementing regulations (50 CFR Part 600).

Please direct any questions regarding this consultation to Ron Lindland of my staff in the Oregon Habitat Branch at (503) 231-2315.

Sincerely,

Russell M Strach for

D. Robert Lohn
Regional Administrator

Endangered Species Act - Section 7 Consultation

Biological Opinion

and

Magnuson-Stevens Fishery Conservation and Management Act

Essential Fish Habitat Consultation

Horning Seed Orchard 2002 Insecticide Application
Clackamas County, Oregon

Agency: Bureau of Land Management, Salem District

Consultation Conducted By: National Marine Fisheries Service,
Northwest Region

Date Issued: March 13, 2002

Issued by: Russell M Strach for

D. Robert Lohn
Regional Administrator

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1. ENDANGERED SPECIES ACT

1.1 Background

The Bureau of Land Management (BLM) requested formal consultation with the National Marine Fisheries Service (NMFS) for Lower Columbia River (LCR) steelhead (*Oncorhynchus mykiss*) and informal consultation for Upper Willamette River (UWR) steelhead on a proposed insecticide application project for 2002 at the Horning Seed Orchard near Colton, Oregon, in a letter received by NMFS on February 21, 2002. A February 19, 2002, biological assessment (BA) for the proposed action accompanied that letter.

The BLM proposes to apply the insecticide Asana XL (esfenvalerate) to control Douglas-fir gallmidge (*Contarinia oregonensis*) and Douglas-fir seed chalcid (*Megastigmas spermotrophus*) at the Horning Seed Orchard. Asana XL would be applied to cone-bearing trees. The purpose of the action is to control cone insects which cause damage and seed loss to orchard cone crops. The proposed action is in conformance with the Salem District Record of Decision and Resource Management Plan (RMP) (BLM 1995). BLM has stated that the Horning Seed Orchard has been administratively withdrawn, and therefore is not required to meet the aquatic conservation strategy (ACS) objectives presented in Appendix A of the *Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl (Northwest Forest Plan)* (USFS/BLM 1994). The Horning Seed Orchard is located northeast of Colton, Oregon (T4S, R3E, Sections 13 and 23) on the topographic divide between Clear Creek (a Clackamas River tributary) and Milk Creek (a Molalla River tributary).

The BLM applied Asana XL to seven units in the Horning Seed Orchard on April 16, 2001. NMFS addressed that action in an April 6, 2001 biological opinion (BO) which concluded that implementation of the project was not likely to jeopardize LCR steelhead or UWR steelhead or destroy or adversely modify their designated critical habitat. The 2002 project would treat trees in five of the same orchard units treated in 2001 as well as in three new units not treated in 2001. Two units treated in 2001 would not be treated in 2002. Monitoring conducted by the BLM during and after the 2001 project indicate that, in general, the application went well. Some additional project design features (listed in Section 1.2.1 below) will be implemented in 2002 to further minimize the potential for waterway contamination and downstream effects on LCR or UWR steelhead.

Prior to requesting consultation for the 2002 project, the Horning Seed Orchard Spray Project was discussed at the October 16, 2001 meeting of the Willamette Level I Team (Team). Team members made a site visit to the Horning Seed Orchard on November 27, 2001 to more completely evaluate site conditions.

The BLM determined in the BA that the proposed Horning Seed Orchard Spray Project "may affect, but is not likely to adversely affect" (NLAA) UWR steelhead or their designated critical habitat in Milk Creek or its tributaries. UWR steelhead were listed as threatened by NMFS under the Endangered Species Act (ESA) on March 25, 1999 (64 FR 14517). Critical habitat was designated for UWR steelhead on February 16, 2000 (65 FR 7764) and protective regulations were issued on July 10, 2000 (65 FR 42422). This determination was reached because: 1) There is no hydrologic connection between the area to be sprayed (Units P30 and P33) and the Milk Creek drainage; 2) surface runoff monitoring during October, November, and December of 2001 indicated that no surface flow occurred from units P30 and P33 even after heavy precipitation on saturated soils; and 3) the inception point (the point at which intermittent flow begins) of the nearest stream which drains into the Milk Creek drainage is approximately 1700 feet away from units P30 and P33. Based on this monitoring information and the November 27, 2001, site visit, NMFS concurs with the BLM's determination that the proposed 2002 project is NLAA UWR steelhead. Because the proposed project is NLAA UWR steelhead, that ESU will not be further addressed in this Opinion.

The BLM determined in the BA that the proposed Horning Seed Orchard Spray Project "may affect, likely to adversely affect" (LAA) LCR steelhead or their designated critical habitat in Clear Creek or its tributaries. This Opinion considers the potential effects of the proposed action on LCR steelhead which are known to occur approximately 1.1 to 1.5 miles downstream from the project site in Clear Creek. Monitoring by the BLM in 2001 indicated that there is a potential for contamination of orchard streams flowing into Clear Creek from either chemical drift or drip during actual spray application. LCR steelhead were listed as threatened by NMFS under the ESA on March 19, 1998 (63 FR 13347). Critical habitat was designated for LCR steelhead on February 16, 2000 (65 FR 7764) and protective regulations were issued on July 10, 2000 (65 FR 42422). The objective of this Opinion is to determine whether the proposed action is likely to jeopardize the continued existence of LCR steelhead or destroy or adversely modify their designated critical habitat. This consultation is conducted pursuant to section 7(a)(2) of the ESA and its implementing regulations, 50 CFR 402.

This Opinion also considers the potential effects of the subject action and serves as a consultation on essential fish habitat for coho salmon (*O. kisutch*) and chinook salmon (*O. tshawytscha*) pursuant to section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act and its implementing regulations, 50 CFR Part 600. Coho salmon distribution is similar to that of steelhead in relation to the project area, while chinook salmon occur 12 to 16 miles downstream from the project area.

1.2 Proposed Action

In the spring of 2002, the BLM proposes to apply the insecticide Asana XL (esfenvalerate) on a total of approximately 19.8 acres in the Horning Seed Orchard (Table 1) to control Douglas-fir cone gallmidge and the Douglas-fir seed chalcid. Of the 19.8 acres to be treated, a total of 12.2 acres are located on the Clear Creek side of the divide, within six units ranging in size from 0.4 to 3.5 acres. The midge generally emerges in late March or April and the chalcid in May. It is unknown at this time if this treatment will be necessary. The need for treatment will depend on the collection of midges or chalcids in insect traps in the spring. Traps will be set to determine the timing of emergence and level of infestation of the two insect species. If insects show up in the traps, a treatment of Asana XL must be applied within a week to be effective. If treatment is needed, it is expected to occur in mid-April. Only one application of Asana XL is planned in 2002. Only one treatment is needed to control both insects if the application is strategically timed.

Asana XL is presently the primary insecticide in use by the seed orchard industry. It is effective for controlling all of the seed and cone damaging insects expected at the orchard and is labeled for aerial application. If used, Asana XL will be applied to only seven selected orchard units. Trees within these units have previously been stimulated to encourage seed production and monitoring indicates that seed production is likely to be high in these units. The units to be treated are identified in Table 1.

Table 1. Proposed Asana XL treatment acres at the Horning Seed Orchard in 2001.

Orchard Unit	Orchard Section	Drainage	Unit Acres	Untreated Buffer Acres(est.)	Net Acres Treated (est.)
P10	Section 13	Clear Creek	1.44	0.85	0.55
P11	Section 13	Clear Creek	2.27	0	2.27
P12	Section 13	Clear Creek	1.8	1.4	0.4
P13	Section 13	Clear Creek	2.46	0	2.46
B35	Section 13	Clear Creek	3.0	0	3.0
B36	Section 13	Clear Creek	3.5	0	3.5
P30, 33	Section 23	Milk Creek	8.6	1.0	7.6
Total			23.07	3.25	19.8

The chemical would be applied through aerial application by helicopter. Asana XL would be applied using an application volume no greater than 0.19 lbs. of active ingredient per acre treated. An application rate of 0.19 lbs active ingredient/acre in not less than 10 gallons of water is identified on the Environmental Protection Agency (EPA) approved label for Asana XL for aerial applications on seed and cone orchards. Applications would occur early in the morning when wind (< 6 mph), humidity and temperature are optimum for minimizing drift. There are no live streams in any of the units receiving the spray. All nearby streams are buffered with natural vegetation, including a relatively dense overstory of conifer and hardwoods. Most of these streams are not perennial where they are near the spray units. See the Project Design Features The specific proposed stream buffers are described below in Section 1.2.1, Project Design Features.

Containers of Asana XL will be stored in the chemical storage building at the orchard. The Asana XL will be mixed with water in a batch truck at the helipad located at the orchard building compound (more than 800 feet from any of the flowing streams). The mixed Asana XL will then be pumped directly from the batch truck into the tanks on the helicopter through a hose which is securely latched into the helicopter tanks before pumping can occur.

1.2.1. Project Design Features

In 2001, the BLM implemented the following conservation measures/project design features to minimize the threat of waterway contamination and downstream effects on LCR steelhead. These same measures, along with additional measures (see below) will be implemented in 2002.

1. Follow all applicable local, state, and Federal laws.

2. Follow guidelines shown on the label for the pesticide being used. These guidelines, required by the Federal Insecticide, Fungicide, and Rodenticide Act, show the list of allowable uses, application rates, and special restrictions for each pesticide. The pesticide would be applied within the prescribed environmental conditions stated on the label. This includes consideration of relative humidity, wind speed, and air temperature when determining the timing of applications relative to drift reduction.

3. Use only licensed pesticide applicators. Applicator licensing and training is an important quality control measure. Training and testing of applicators covers laws and safety, protection of the environment, handling and disposal, pesticide formulations and application methods, calibration of devices, use of labels and data sheets, first aid, symptoms of pesticide exposure, and other activities.

4. Spray would be applied about 20 feet above the orchard canopy. This will optimize the amount of spray reaching the target trees and reduce the amount reaching the ground.

5. Treatment will occur early in the morning when wind is minimal (<6 mph) to prevent drift, and preferably when there is no wind. Applications adjacent to no-spray buffers will occur when winds are calm. Wind speed will be monitored on-site prior to and during spray applications. Operations will be suspended if wind speeds exceed 6 mph. **Application will not occur when wind direction is toward flowing streams.**

6. Application will not occur on days that rainfall or fog is likely to occur. Additionally, there will be no application of Asana XL when rainfall is expected to exceed .5 inches per hour within the three days following application. This is the most reliable forecast window and will avoid the potential of exceeding the infiltration rates of the soil.

7. The helicopter will treat orchard blocks adjacent to stream buffers by flying parallel to the buffer for the initial spray fly-over. This will reduce the likelihood of accidental overspray into the buffer.

8. At a minimum, stream course and wetland buffers will be established within guidelines prescribed by the pesticide label (See also design features 10 and 11).

9. No spraying will be done over ponds, reservoirs or live streams.

10. Stream 2b (a tributary to Swagger Creek) (Orchard Units P-10 and P-12) will receive a 200-foot buffer from the edge of the stream channel. No spraying will occur in this buffer. This will provide a conservative distance from potential flowing water to avoid drift and increase the distance for capture of any potential runoff by organic material.

11. All other flowing streams will receive buffers of greater than 200 feet by virtue of the existing vegetative buffers, with the exception of stream 5 which has a buffer of tall conifers which is 160 feet wide at its narrowest point. No spraying will occur in these buffers. This will provide considerable opportunity for capture of any sediment and re-introduction of potential surface runoff into organic and soil material.

12. Infiltration of rainfall into the soil and avoidance of potential runoff will be promoted through use of aerating equipment in the orchard blocks proposed for, and prior to, application.

13. If rain has preceded the intended application window, units will be checked for their infiltration capacity. Application will not occur if soils are in a saturated condition.

14. The BLM will assure that equipment used for transport, mixing, and application will not leak pesticides into water or soil. Areas used for mixing pesticides and cleaning equipment will be located where spillage would not run into surface-waters or result in ground-water contamination.

15. All chemical loading operations will occur within the orchard building compound. This is more than 1,600 feet from any of the flowing streams. The BLM will assure that equipment used for transport, mixing, and application will not leak pesticides onto the soil of the compound area.

16. Procedures outlined in the Spill Prevention and Countermeasure Containment Plan will be followed if there is any spill of Asana XL.

17. A spill containment kit will be on-site at the orchard building compound. Chemical containers will be kept in plastic drip pans which are large enough to hold the entire volume of each container in case the containers develop leaks.

18. Sensitive non-target areas will be protected with an additional buffer from treatment areas. The size of the buffers will be determined by the flight direction of the aircraft, the height of the trees being treated, weather conditions (primarily wind direction and speed) and the pilot's ability to regulate the dispersal of the spray. The width of the buffers are typically identified using bright flagging and/or orange highway cones for easy pilot identification. The project boundaries will be reviewed using aerial photos and a reconnaissance on the ground by the pilot and BLM project leader within minutes of beginning treatment.

19. Areas immediately adjacent to all no-spray buffers will be treated prior to spraying the remainder of any of the units.

20. The BLM will comply with the Pesticide Safety Plan.

21. Base-line health testing of workers for exposure will continue.

22. Prior to pesticide application, the BLM will notify downstream water users within one-half mile of the project area and adjacent landowners who could be directly affected by accidental drift and water transport from normal operation.

23. The BLM will post Material Safety Data Sheets at storage facilities and make them available to workers. These sheets provide physical and chemical data, fire and reactivity data, specific health hazard information, spill or leak procedure, instructions for worker hygiene, and special precautions.

24. The BLM will require appropriate protective clothing for all workers. At a minimum, the type and amount of protective clothing listed on the pesticide label must be used. For Asana XL, this consists of long-sleeved shirt and long pants, chemical-resistant gloves, shoes and socks, and protective eye wear.

25. Orchard workers who know they are hypersensitive to pesticides would not be assigned to application projects. Workers who display symptoms of hypersensitivity to pesticides during application would be reassigned to other duties.

26. The BLM will post treated areas as "off limits" to discourage entry into treated areas until the spray has dried, unless protective clothing is worn, and entry is permitted by instruction on the pesticide label.

27. When specific conditions warrant, the orchard manager could implement one, or any, of the following additional design features to further reduce worker exposure:

    a. Increase the level of protective clothing worn

b. Lengthen re-entry time for workers.
c. Reduce worker exposure periods to the pesticide.
d. Reduce pesticide application rates.
e. Reduce the area being treated on a given day.

28. The BLM will monitor air temperatures carefully. Spraying will be avoided during the day when bees are active.

29. Prior to insecticide applications, the BLM will mow or graze orchard fields to remove floral components so as to minimize the presence of pollinators, such as bees if they are active, to prevent exposure to the insecticide.

30. The BLM will spray in early morning to allow foliage to dry before pollinators become active.

In 2002, the following additional design features will be implemented to further minimize the potential for chemical drift or drip during the application of Asana XL:

1. The BLM will place drift cards along all sensitive buffers and along stream channels where drift or drip entry is possible. These would generally be placed along stream buffers and under the designated flight path which crosses stream 6b (a tributary to Swagger Creek).

2. The BLM will flag a designated corridor for helicopter flight path across stream 6b. The helicopter will travel from load area to application areas in Units B-35 and B-36 using this corridor, making only one going and returning flight. This is intended to reduce potential for drip.

3. If reconnaissance flights need to be made over waterbodies, these flights will be made with empty tanks or no flights will be made over surface water.

4. Flight paths during operation will not be located over surface waterbodies except for designated corridor across stream 6b.

5. Buffer width on Stream 5 will be 160 + feet, Stream 2 buffer will be 200 feet and Stream 6 buffer will be 300 feet.

6. BLM will clearly mark the application units and buffer boundaries with visible cones and flagging in such a manner that would allow visual identification from the air.

7. Spray out areas will be in Orchard Unit B-50 & B-11 (Greenhouse effluent irrigation area). There are no streams near these units.

After discussing BLM's objectives and concerns, the helicopter pilot who will be applying the spray offered the following mitigation measures, which will also be implemented:

1. In units P10, 11 , 12 and 13, flights will be made one way, east to west in order to provide maximum control against the private boundary. This will provide for parallel flights to the sensitive areas and avoid banked turns against the buffers.

2. Application flight paths for units P 36 and 35 will be made in an east to west orientation as to avoid bank turn against existing buffer.

3. In order to provide maximum spray control, the helicopter will operate around the buffer areas with the boom closest to the sensitive area turned off.

4. BLM will deploy smoke flares in each unit prior to application to provide for pilot recognition of wind speed and direction.

In addition to the above design features, the recommendations and precautions on the Asana XL label will be met. These include (not a complete listing):

1. Do not apply by ground within 25 feet, or by air within 150 feet of lakes; reservoirs; permanent streams, marshes, or natural ponds; estuaries; and commercial fish farm ponds. (Design features require a minimum 200-foot distance between the treated areas and streams/ponds.)

2. For aerial applications, the spray boom should be mounted on the aircraft so as to minimize drift caused by wing tip vortices. The minimum practical boom length should be used, and must not exceed 75% of the wing span or rotor diameter.

3. Spray should be released at the lowest height consistent with pest control and flight safety. Applications more than 10 feet above the crop canopy should be avoided. (The design features of this project call for the helicopter to be within 20 feet of the tree tops. This is a safety feature that accounts for the varying height of individual trees within the orchard units).

4. Make aerial or ground applications when the wind velocity favors on-target product deposition (approximately 3 to 10 mph). Do not apply when wind velocity exceeds 15 mph. Avoid applications when wind gusts approach 15 mph. (The design features of this project restrict application when wind velocity exceeds 6 mph).

5. Risk of exposure to aquatic areas can be reduced by avoiding applications when wind direction is toward the aquatic area.

6. Do not cultivate within 10 feet of the aquatic area so as to allow growth of a vegetative filter strip. (The orchard units have vegetated riparian buffers on perennial flowing streams which range from 45 feet to 280 feet or wider. All perennial and intermittent channels will be 200 feet or more from the treated areas. The area between the streams and the treated field portions is covered with a dense growth of grass).

7. Low humidity and high temperatures increase evaporation rate of spray droplets and therefore the likelihood of increased spray drift to aquatic areas. Avoid spraying during conditions of low humidity and/or high temperatures. (The proposed application will occur in the early morning when humidity is high and air temperatures are low).

8. Do not make aerial or ground applications during temperature inversions.

1.2.2. Project Monitoring

The BLM proposes to conduct the following monitoring in 2002:

1. Wind speed will be monitored on-site prior to and during spray applications. Operations will be suspended if wind speeds exceed 6 mph.

2. Water quality monitoring for detectible concentrations of esfenvalerate will be conducted immediately before and after the aerial spray. This will be done in channels 2b, 5a and 6a. The results of this monitoring combined with the results from the spray cards should provide evidence of the immediate impacts from any potential drift.

3. Drift of aerially applied chemicals will be monitored during the spray operations using 4" X 5 ½" spray cards to detect the presence of drift and the relative amount. Spray cards will be installed along the perimeter of the treatment area, approximately every 50 to 100 feet in sensitive areas such as along stream buffers. The width of the buffers are typically identified using bright colored flagging and/or orange highway cones for easy pilot identification. The project boundaries are reviewed using aerial photos and a reconnaissance on the ground by the pilot and BLM project leader within minutes of beginning the spray treatment Application techniques would be altered or spray operations would cease if drift were detected.

4. The monitoring plan to be implemented by BLM in 2002 is described in Appendix A. The goal of this plan is to determine if implementation of the 2002 Horning Seed Orchard spray plan results in any short term presence of Asana XL in streams due to drift or drip. Surface runoff monitoring stations in units P-12 (stream 2) and P-13 (stream 3) will also be monitored in the event of a precipitation event within the days following spray application.

1.2.2.1 Results of 2001 Monitoring

During and after the 2001 spray application at the Horning Seed Orchard, the BLM conducted monitoring to detect drift of the spray or transport by surface water runoff. Results of that monitoring are summarized below.

Drift monitoring:

Drift cards: Spray detection cards were placed in strategic locations throughout the application area in order to document drift from the treatment area. Immediately after the application, the cards were collected and reviewed to determine if any drift had been detected, the extent of the drift, and the potential for contamination of the adjacent water bodies. The results indicate that only one location had a recorded "hit" outside of the treatment area. This location was in Orchard Unit P12 at approximately 15 feet from the edge of the treatment area. This location is in proximity to where it was noted that the pilot made a steep bank turn against the buffer. Helicopter rotor wash could have expanded the extent of spray coverage. There were no "hits" recorded on the spray card that was placed 60 feet from the treatment edge. There were no "hits" on cards at either side of the contaminated spray card (along a 25-foot line parallel to the treatment edge). There was one card along the buffer in unit B-14 which contained minor evidence of sporadic drift.

Surface water monitoring for drift: All samples were delivered to the Pacific Agricultural Lab and completed within the lab specified holding time. Pacific Agricultural Laboratory is a State certified laboratory which analyzed the samples according to a modified EPA Method 8081A (GC-ECD) with detection limits down to 0.02 ppb for Asana XL. The lab was able to provide a detection limit for the drift samples at 0.02 ppb due to the large number of samples that were provided in a short period of time. Samples were collected in accordance with laboratory instructions.

Monitoring results indicate that introduction of esfenvalerate occurred in two stream locations. This occurred despite overall compliance and implementation of design features and mitigating measures contained in the 2001 BA and BO.

Stream Reach 5a, as monitored at site P-11, had the highest and longest duration of concentration. Concentrations of 0.4 ppb and 0.061 ppb were detected in the 15-minute sample and 2-hour samples, respectively. Since there were no drift cards along this boundary it is difficult to determine definitively if drift was the entry mechanism. Calm conditions (less than 3 mph wind speed) prevailed throughout the 2001 application period so it is thought that climatic conditions were not a factor. It was noted that during application in the Orchard Unit P-11, the helicopter made high banking turns over the riparian buffer in carrying out the application flight path. During these turns the rotor attitude could have carried the pesticide into the buffer, especially if the nozzles were not turned off at the proper time. It was also noted that the flight path from Orchard Unit B-14 to Orchard Unit B-34 caused the helicopter to fly over the stream between applications. Dripping booms could have provided another entry point.

Stream 2, a non fish-bearing stream, was monitored at two sites. Site B-14 was located at the inception point of stream 2 while site P-12 was located approximately 800 feet downstream. Site B-14, had a detectible concentration (0.032 ppb) which was above the detectible limit (0.02 ppb) in only the 2 hour sample. The two hour sample was the second sample taken after the initial spray swath in unit B-14. Due to the headwater nature (intervening wetlands) of this site, the travel time for detection could have been miscalculated, so instead of the concentrations showing up at the first sample (15 minute sample), it was recorded at the two hour sample. Review of the spray cards from the unit indicated that there were no typical spray "signatures" on the cards located in the no treatment area. After the water quality results were provided, further review of the cards did show some limited and highly variable splatter on one card. Entry into the stream system is assumed to be from drift. As in the discussion above, rotor wash on the edge of the unit could provide the mechanism for drift when background winds are calm. The buffer around this headwater site was designed as a semi-circle around the stream initiation point and was largely made up of orchard tree canopies and grass species. Site P-12 did not have a detectible concentration during any of the time steps monitored according to the Oregon Department of Forestry (ODF) protocol. Continuous one hour samples over a 24 hour period at this site also recorded no detectible concentrations. The reason for this lack of detection could be two-fold: dilution could reduce concentrations below detectible limits and/or the esfenvalerate became attenuated in the organic matter, sediment and vegetation between sites. The fact that there was no detection at the P-12 site suggests that design features used in the P-12 unit were effective.

Fish species of concern include cutthroat trout (addressed in a separate Opinion issued by the U.S. Fish and Wildlife Service) in Stream Reach 5a (Site P-11) and LCR steelhead in Clear Creek approximately 1 to1.5 miles downstream from the orchard. The concentration of Asana XL in the 15 minute sample at Site P-11 (0.4 ppb) exceeded the 96 hr. LC50 values for both fry (0.09 ppb) and adult trout (0.3 ppb). However, any cutthroat trout which may have been present in Stream Reach 5a were not exposed to this concentration for very long, and LCR steelhead are not present in this stream reach. The concentration in the two hour sample (0.06 ppb) was less than the LC50 values for both life stages and no detectable concentrations were found in later samples. No attempt to observe dead or injured fish was made since the BLM was unaware of the contamination until the water samples had been analyzed (about two weeks after spray application). The estimated population of cutthroat trout in Stream 5 is very low, and combined with the dense brush along the stream, would make the observation of dead fish very unlikely. The effects of this short-term exposure to the cutthroat trout in Stream 5 are unknown. For ESA-listed aquatic organisms there is a "presumption of unacceptable risk" if the expected exposure concentration is greater than 1/20 LC50. The concentrations at both the 15 minute sample and the 2 hour sample exceeded the 1/20 LC50 values for adult (0.015 ppb) and fry (0.0045 ppb) trout.

It is not likely that the concentration of Asana XL that may have entered Clear Creek, over one mile downstream from stream reach 5a, would have had any effect on LCR steelhead. The estimated 24 hour concentration in Clear Creek (0.0000056 ppb) is 1000 times lower the 1/20 LC50 value for trout fry (0.0045 ppb). It is possible that no Asana XL ever actually reached Clear Creek. A concentration of 0.032 ppb was detected at Site B-14 on Stream 2 (non fish-bearing), however, no detectable levels were ever collected at Site P-12 which was only about 800 feet downstream.

Field Runoff Monitoring- 72 Hour, Spring Runoff , and Fall/Winter Runoff

The water quality sampling for field runoff targeted three monitoring periods: 72 hours immediately following the application, the spring runoff period, and fall/winter runoff periods of 2001. Runoff monitoring was conducted at five sites in Orchard Units B-34, B-14, P-30, P-11 and P-12. During this time, Stream Site P-12 was also monitored for comparison with field results. Precipitation and streamflow were also continuously monitored in the orchard throughout the runoff periods.

All samples were delivered to the Pacific Agricultural Lab and completed within the lab specified holding time. Pacific Agricultural Laboratory is a State certified laboratory which analyzed the samples according to a modified EPA Method 8081A (GC-ECD) with detection limits down to 0.04 ppb for esfenvalerate. The lab changed the detection limit for the runoff samples to 0.04 ppb because the limited and sporadic collection of samples did not make it cost effective to test at the 0.02 ppb level. Samples were collected in accordance with laboratory instructions.

72 Hour / Spring Runoff: In terms of the 72 hour and the spring 2001 period, Site P-12 was selected as the most "at risk" location due to the amount sprayed in the contributing watershed and the proximity of application to live water. This site was sampled continuously through rainfall events using a pumping sampler at two hour intervals. The first three significant storm periods were sampled over the following month, one of which occurred within 24 hours of the spray application. None of these events were of sufficient intensity or duration to cause surface runoff in the application units. However, significant increases in stream flow did occur in response to storm events. Analysis of these samples was conducted despite the low probability that there would be any detectible concentrations. This was done to validate previous assumptions concerning the high adsorption and low mobility of esfenvalerate in the soil profile and low potential of introduction to groundwater/surface water interaction. The results of lab analysis of these events all reflect non-detectible concentrations at a detection limit of 0.02 ppb. No further spring sampling was conducted beyond this initial 72 hour period, as no rainfall occurred at intensities greater than those experienced during this period.

Fall/Winter 2001 Runoff: During the fall and winter period 2001 there were numerous storm events. However, there were only two that had potential to generate field runoff. During this time, runoff only occurred at two sites: B-14 and **P-13**. The results of lab analysis for these sampled field runoff events all reflect non-detectible concentrations at a detection limit of 0.04 ppb. The lack of surface runoff at sites B-34, P-12 and P-30 is explained by a number of factors including smaller catchment area, beneficial aeration completed prior to application, and higher infiltration rates than initially estimated.

Streamflow concentrations were monitored during the high flows of December when field runoff occurred at B-14. The lab analysis results from these sampled streamflow events reflect non-detectible concentrations at a detection limit of 0.04 ppb.

1.3. Biological Information and Critical Habitat

The listing status and biological information for LCR steelhead is described in Busby et al. (1996) and NMFS (1997). The NMFS designated critical habitat for LCR steelhead on February 16, 2000 (65 FR 7764) and applied protective regulations under section 4(d) of the ESA on July 10, 2000 (65 FR 42422). The Horning Seed Orchard project is located upstream from LCR steelhead designated critical habitat in Clear Creek.

The Horning Seed Orchard is located on the divide between Clear Creek (a Clackamas River tributary) and Milk Creek (a Molalla River tributary). Clear Creek is within designated critical habitat for LCR steelhead and Milk Creek is within designated critical habitat for UWR steelhead. According to the BA, neither of these steelhead ESUs is present within any of the streams on the seed orchard property. LCR steelhead utilize Clear Creek for spawning and rearing in the vicinity of its confluence with Swagger Creek, approximately 1.1 miles downstream from the seed orchard.

Critical habitat for LCR steelhead includes the Columbia River and its tributaries between the Cowlitz and Wind Rivers in Washington and the Willamette and Hood Rivers in Oregon, inclusive. Excluded are steelhead in the upper Willamette River Basin above Willamette Falls, and steelhead from the Little and Big White Salmon Rivers in Washington. Freshwater critical habitat includes all waterways, substrates, and adjacent riparian areas—areas adjacent to a stream that provides the following functions: Shade, sediment, nutrient or chemical regulation, streambank stability, and input of large woody debris or organic matter—below longstanding, natural impassable barriers (i.e., natural waterfalls in existence for at least several hundred years) and several dams that block access to former LCR steelhead habitat. The proposed action would not occur in designated critical habitat for LCR steelhead.

1.4. Evaluating Proposed Action

The standards for determining jeopardy are set forth in section 7(a)(2) of the ESA as defined by 50 CFR Part 402 (the consultation regulations). In conducting analyses of habitat-altering actions under section 7 of the ESA, NMFS uses the following steps: (1) Consider the status and biological requirements of the species; (2) evaluate the relevance of the environmental baseline in the action area to the species' current status; (3) determine the effects of the proposed or continuing action on the species; (4) consider cumulative effects; and (5) determine whether the proposed action, in light of the above factors, is likely to appreciably reduce the likelihood of species survival in the wild or adversely modify its critical habitat. In completing this step of the analysis, NMFS determines whether the action under consultation, together with all cumulative effects when added to the environmental baseline, is likely to jeopardize the continued existence of the listed species, and/or result in destruction or adverse modification of their critical habitat. If NMFS finds that the action is likely to jeopardize the listed species, NMFS must identify reasonable and prudent alternatives for the action.

1.4.1. Biological Requirements

The first step in the method NMFS uses for applying the ESA section 7(a)(2) to listed salmon is to define the biological requirements of the species most relevant to each consultation. NMFS also considers the current status of the listed species by taking into account population size, trends, distribution and genetic diversity. To assess the current status of the listed species, NMFS starts with the determinations made in its decision to list LCR steelhead for ESA protection and also considers new data available that are relevant to the determination (Busby *et al.* 1996).

The relevant biological requirements are those necessary for LCR steelhead to survive and recover to naturally-reproducing population levels at which protection under the ESA would become unnecessary. Adequate population levels must safeguard the genetic diversity of the listed stock, enhance their capacity to adapt to various environmental conditions, and allow them to become self-sustaining in the natural environment.

For this consultation, the biological requirements are habitat characteristics that function to support successful spawning, rearing and migration. The current status of the LCR steelhead, based upon their risk of extinction, has not significantly improved since the species was listed and, in some cases, their status may have worsened.

1.4.2. Environmental Baseline

The environmental baseline is an analysis of the effects of past and on-going human and natural factors leading to the current status of the species or its habitat and ecosystem within the action area. The action area is defined as all areas (bankline, adjacent riparian zone, and aquatic area) to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). Direct effects occur at the project site and may extend upstream or downstream based on the potential for impairing fish passage, hydraulics, sediment and pollutant discharge, and the extent of riparian habitat modifications. Indirect affects may occur throughout the watershed where actions described in this Opinion lead to additional activities or affect ecological functions contributing to stream degradation. For this consultation, the action area includes the treatment units and all hydrologically-connected waterways in the Clear Creek drainage downstream to the Clackamas River.

The Horning Seed Orchard was established in 1964, with the long-term objective of providing a continuous supply of high quality, healthy conifer seed. The seed is used to grow seedlings on a continuing basis for reforesting harvested areas. The seed orchard occupies approximately 800 acres, of which 248 are in active seed production. Approximately 19.8 acres is proposed for spray treatment in 2002. Tree species maintained at the orchard include Douglas-fir, noble fir, western hemlock, western red cedar, sugar pine, and western white pine. Approximately 200 acres are grazed annually by cattle and sheep, hay is harvested from 165 acres, and 90 acres are mowed twice per year.

Clear Creek is not on the Oregon Department of Environmental Quality (ODEQ) 303(d) List of Water Quality Limited Water Bodies. Approximately 94 percent of the Clear Creek watershed is privately owned, and much of the valley bottom area is used for rural residential and agricultural purposes. In addition, much of the watershed was logged prior to the 1950's.

1.5. Analysis of Effects

1.5.1. Effects of Proposed Action

The effects of chemical insecticide use frequently extend beyond the intended target species. Insecticide composition (including inert ingredients, carrier agents, and surfactants), chemical character, environmental conditions, and application techniques are among the parameters that determine the degree to which insecticide effects will impact non-target species and their ecosystems. Scientific studies have documented lethal effects, and to a lesser degree sublethal effects of active ingredients, on many species. These studies are typically laboratory derived and findings may vary greatly. For example, pyrethroid LC_{50} concentrations for salmonids have been shown to vary considerably (Table 2). Field conditions may provide some ameliorating circumstances that may reduce exhibited chemical toxicity. Smith and Stratton (1986) state, "field applications usually have no pronounced effects on *in situ* fish survival." Furthermore, inert ingredient toxicity is frequently overlooked and is often little studied or understood. However, the myriad of possible chemical/species interactions frequently necessitate that chemical classes and/or species groups must be used as the best available science to anticipate potential effects on a particular species.

Table 2. Smith and Stratton (1986) indicate lethal concentrations for pyrethroid insecticides on salmonids vary.

Coho Salmon
- 96 hr LC_{50} = 22.2 mu g/L allethrin (Mauck *et al*. 1976).

Rainbow Trout
- 24 hr LC_{50} = 3.8 mu g/L fenvalerate (Mulla *et al*. 1978).
- 24 hr LC_{50} = 4.7 mu g/L fenvalerate (Holcombe *et al*. 1982).
- 24 hr LC_{50} = 76 mu g/L fenvalerate (Coats and O'Donnell-Jeffrey 1979).
- 48 hr LC_{50} = 3.0 mu g/L fenvalerate (Mulla *et al*. 1978).
- 96 hr LC_{50} = 0.32 mu g/L flucythrinate (Worthing and Walker 1983).
- 96 hr LC_{50} = 2.1 mu g/L fenvalerate (Holcombe *et al*. 1982).
- 96 hr LC_{50} = 17.5 mu g/L allethrin (Mauck *et al*. 1976).

Atlantic Salmon
- lethal threshold = 0.46 mu g/L fenvalerate (McLeese *et al*. 1980).
- 96 hr LC_{50} = 1.2 mu g/L fenvalerate (McLeese *et al*. 1980).

Similarly, there is currently a question of the adequacy of using LC_{50} values to predict *take*[1] in the context of the ESA. Little *et al*. (1990) noted behavioral changes in rainbow trout at chlordane (organochlorine insecticide) concentrations below EPA's not-to-be-exceeded concentration illustrating the inadequacy of using current EPA application guidelines for avoiding sublethal effects.

Esfenvalerate is comprised of esfenvalerate (8.4%) and inert ingredients (91.6%), including two potentially toxic substances that have a high priority with the EPA for testing: xylene (<3%) and ethylbenzene (<1%). Esfenvalerate is a synthetic pyrethroid insecticide and is registered as a moderately toxic insecticide for use for forestry, range, conifer seed orchards, forest tree nurseries, and right-of-way pest control. Esfenvalerate is a sodium channel blocker that kills insects on contact or ingestion. Non-target insects may similarly be effected.

Pyrethroids, including esfenvalerate, are highly toxic to aquatic invertebrates and fish (Moore and Waring 2001, Tanner and Knuth 1996, Little *et al.* 1993, Eisler 1992, Smith and Stratton 1986, Curtis *et al.* 1985). Eisler (1992) states that use of synthetic pyrethroid insecticides should be done with extreme caution in habitats of endangered species, but that few environmental problems to aquatic organisms have been documented. Fenvalerate LC_{50} concentrations for mayflies range from 0.07-0.93 mu g/L and for stoneflies is 0.13 mu g/L (Smith and Stratton 1986). The esfenvalerate 96-hour LC_{50} concentration for rainbow trout (*Oncorhynchus mykiss*) is

[1]To harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in any such conduct.

0.3 mu g/L (Extoxnet website at <http://ace.orst.edu/cgi-bin/mfs/01/pips>). Curtis *et al.* (1986) found a 96-hour fenvalerate LC_{50} concentration for alevin rainbow trout of 0.09 mu g/L.

Sublethal effects in fish have been documented at recommended rates of application (Smith and Stratton 1986). As stated in Smith and Stratton (1986), "Pyrethroids are lipophilic and are likely to be strongly absorbed by the gills, even from water containing very low pesticide concentrations." While little is known regarding the sublethal effects of esfenvalerate on steelhead in particular, a recent study of a synthetic pyrethroid insecticide on Atlantic salmon (*Salmo salar*) found male parr exhibited an inhibited olfactory response following a five day exposure to concentrations of less than 0.004 mu g/L or 4 parts per trillion (Moore and Waring 2001). The same study found exposure of milt and eggs to a concentration of 0.1 mu g/L reduced egg fertilization. Bluegill (*Lepomis macrochirus*) exposed to pulses of low esfenvalerate concentrations (0.025 mu g/L) exhibited behavioral responses including gross body tremors within 4 hours (Little et al. 1993). Esfenvalerate may bioaccumulate in the tissues of fish and other aquatic organisms, but is not known to biomagnify. Smith and Stratton (1986) state that synthetic pyrethroid insecticides are rapidly eliminated from tissue after discontinuation of exposure and are not expected to biomagnify through the food chain.

The persistence of esfenvalerate varies upon environmental conditions with half-lives in direct sunlight, soil, and water being 7.5 days, up to 90 days, and 10 to 220 days, respectively. At least one study found pyrethroids to be "relatively non-persistent and do not accumulate in the environment" (Smith and Stratton 1986). Chapman *et al*. (1981) applied 1 part per million of the pyrethroid fenvalerate to mineral and organic soils. Eight weeks after application, 12% of the applied fenvalerate remained in the mineral soil sample, and 58% remained in the organic soil sample. Another study that applied esfenvalerate in two applications 30 days apart directly to littoral enclosures found maximum water concentrations within 1 to 3 hours after application and only 10% remained after 24 hours (Heinis and Knuth 1992). Esfenvalerate concentrations were undetectable (0.047 mu g/L) in water within 4 days. And yet, the same littoral enclosure study found: "Water and sediment, and, to a lesser extent, aquatic vegetation and macrophytes, were important reservoirs for esfenvalerate" (Heinis and Knuth 1992). In general, soil organisms and photodegradation breakdown esfenvalerate in the environment producing carbon dioxide, acid, and alcohol. Esfenvalerate readily binds to organic matter in the soil, has little mobility, and is practically insoluble in water. The potential for leaching into groundwater is very low.

The inert esfenvalerate ingredient xylene very quickly evaporates into the air from surface water and soil where it may remain for several days until it is broken down by sunlight. Because xylene is applied as a liquid, it does have the potential to infiltrate into the soil. Most xylene in surface water evaporates into the air in less than a day. Xylene is more persistent in groundwater where evaporation is impaired.

The inert esfenvalerate ingredient ethylbenzene is most commonly found in vapor form since it moves easily into the air from water and soil. In the air, ethylbenzene is broken down by sunlight in approximately 3 days. In surface water, it breaks down by reacting with other compounds. In soils, ethylbenzene is broken down by bacteria.

1.5.2. Vectors of Exposure

There are three primary scenarios of how esfenvalerate could reach stream channels, reservoirs, and wetlands due to the proposed action: 1) Drift from the aerial spray, 2) runoff from the fields to which spray is applied, and 3) potential spills in and near stream channels.

Direct effects resulting from esfenvalerate are predominately associated with contamination of waterways resulting from drift. Drift is dependent on gravity, air movement, and droplet size (NebGuide website at <http://www.ianr.unl.edu/pubs/pesticides/g1001.htm>). Smaller droplets stay aloft longer and the longer a droplet is suspended the greater the potential for it to be translocated by air currents. A droplet size of 100 microns (mist) takes 11 seconds to fall 10 feet in still air. The same size droplet would travel 13.4 feet in a 1 mph wind while dropping that same 10 feet, and 77 feet at 5 mph (NebGuide website). Application pressure, nozzle size, nozzle type, spray angle, and spray volume are all factors in determining droplet size. Droplet sizes increase with decreasing pressure and larger nozzle sizes. An indicated droplet size (i.e., 300 microns) really represents a median diameter of all droplets. Actual droplet sizes will range from considerably smaller as well as larger than the indicated droplet size. During temperature inversions little vertical air mixing occurs and drift can translocate contaminates several miles (NebGuide website). In addition, low relative humidity and/or high temperature conditions will increase evaporation and the potential for drift. Proposed buffers, application criteria, and concurrent drift monitoring should minimize this risk. Cessation of operations criteria includes positive hits on drift cards located 60 feet from the treatment unit or any hits beyond the aeration zone. Past monitoring of esfenvalerate applications at the Horning Seed Orchard indicates that if esfenvalerate is applied under calm conditions there should be little drift of the spray. Nearly all nearby streams are buffered with natural vegetation, including a relatively dense overstory of conifer and hardwoods. Most of these streams are not perennial where they are near the spray units. A 200 foot buffer on stream 2b will reduce the potential for drift to enter that stream (Table 3). Spills near any water will be avoided through siting the mixing and loading zones in the compound area (greater than 1,600 feet from flowing water). Transit of the helicopter between units will not occur over any surface water, with the exception of Units B35 and B36 when the helicopter must fly over stream 6b. These best management practices should avoid the scenario of drift and spill delivery of esfenvalerate to surface waters.

Table 3. Approximate distance from orchard units to surface water.

Drainage	Orchard Section	Orchard Unit	Closest Tributary Channel	Approx. Distance to Surface Water (intermittent flow) in feet	Buffer Distance in Proposed Action
Clear Creek	Section 13	P10	stream 2b	30-85	200
		P11	stream 5a	160+	160+
		P12	stream 2b	45-50	200
		P13	stream 5a	200 - 280	200 - 280
		B35	stream 6 stream 7a*	325 290	325 290
		B36	stream 6 stream 6 trib.	430 300	430 300
Milk Creek	Section 23	P30, 33	stream 10a stream 8a	1700 830	1700 830

*Stream 7a has no discernable surface channel adjacent to B-35.

Post-application direct effects may occur in association with rain events that may transport the chemicals to waterways, which will convey them downstream to LCR steelhead habitat. The adsorption potential, stability, solubility, and toxicity of a chemical determines the extent to which it will migrate and adversely effect surface waters and groundwater (Spence *et al.* 1996). The insolubility and strong adsorbing characteristics of esfenvalerate make this chemical unlikely to leach through soils and if sediment transport is precluded, transport to waterways should be minimal. However, the high toxicity and persistence of esfenvalerate means the chemical remains a significant contamination threat longer, maybe well into the fall wet season. Considering minimum 200-foot buffers, biodegradation, and chemical half-lives, contaminate concentrations should be insignificant by the time surface water entry occurs.

The potential for runoff or surface leaching (top few inches of soil profile) from treatment units was modeled by BLM using the Groundwater Loading Effects of Agricultural Management Systems (GLEAMS) model version 3.01. The GLEAMS model, developed by the USDA Agricultural Research Service, is a computerized mathematical model developed for field-sized areas to evaluate the movement and degradation of chemicals within the plant root zone under various crop management systems. The model has been tested and validated using a variety of data on pesticide movement.

GLEAMS has four main components: Hydrology, erosion, nutrients, and pesticides (the nutrients component is for fertilizer applications only). The hydrology component subdivides the soil within the rooting zone into as many as 12 computational layers. Soils data describing porosity, water retention characteristics, and organic matter content for the site-specific soil layers are collected for model initialization. During simulation, GLEAMS computes a continuous accounting of the water balance for each layer, including percolation, evaporation, and transpiration. The erosion component accounts not only for the basic soil particle size categories (sand, silt, and clay), but also for small and large aggregates of soil particles. The program accounts for the unequal distribution of organic matter between soil fractions. The pesticide component can represent chemical deposition directly on the soil, the interception of chemicals by foliage, and subsequent washoff. Degradation rates are allowed to differ between plant surfaces and soil, and between soil horizons. Input data required by the GLEAMS model consist of five separate files: Rainfall data, temperature data, hydrology parameters, erosion parameters, and chemical parameters. Output from the GLEAMS model includes accounting of concentrations by soil layer for each chemical, and the movement of pesticide residues in percolating soil waters, surface runoff waters, and those residues sorbed to eroding soil particles on a daily basis.

GLEAMS can model the concentration of chemical that will leave a target field, in this case an orchard block, that is transported by overland flow or that is sorbed to soil particles that are transported in the flow. The estimate is based on a representative five-year precipitation record and represents the proportion of days within the five-year span during which the chemical would leave the treatment unit. The assumption is that this overland flow is collected in a stream at the edge of the field. In reality, varying widths of vegetative buffers exist between the modeled finding and any stream channels within the orchard. The model is not able to predict chemical concentrations reaching streams which are separated from the target fields by buffer areas. Furthermore, any mixing, dilution, or reduction of the chemical that may result as it travels the 1.1 to 1.5 miles, depending on the treatment unit, downstream to LCR steelhead habitat in Clear Creek cannot be modeled.

There are no stream channels in any of the orchard units nor are there any channels connecting the units to any intermittent or perennial channels. There are topographic draws within the units but any surface flow in these draws is ephemeral and would occur only in direct response to heavy precipitation. The ephemeral draws are covered with a dense mat of grass and moss ground cover which effectively prevents surface erosion. If any surface flow occurs in these draws there will likely be negligible movement of contaminated soil off the fields. There is no hydrologic connection between units P-30/33 and stream 10. The head of stream segment 10b, an ephemeral draw, is about 150 feet from units P-30/33; there is no surface channel between 10b and the units. Additionally, stream segment 10a has no defined surface channel. The inception point for stream segment 10a, the point at which intermittent flow begins, is approximately 1,700 feet away from units P-30/33.

The runoff and sediment concentrations predicted by the GLEAMS model are assumed to be the "edge of field" concentrations. The model is not able to predict the fate of chemical runoff and sediment concentrations moving through riparian buffers and wetland sites. All of the streams at the seed orchard have an existing densely vegetated riparian zone which range in width from around 40 feet to several hundred feet. These areas contain uncompacted soils with thick surface litter and high organic matter content. It is very likely that most of the esfenvalerate that the model predicts could runoff from the orchard units, would be captured in the riparian buffers through adsorption to soil and organics. Many of the intermittent and perennial streams have a wetland system along the channel edge. These too would offer adsorption sites for runoff events. Since the fate of the chemical within these buffers cannot be modeled, a conservative approach was taken. It was assumed that the concentration of esfenvalerate leaving the fields was the amount entering the streams. For this reason, the concentrations of esfenvalerate predicted in the modeling are likely to be significantly higher than any actual stream concentrations (if any) that may result from implementation of the proposed action.

Since GLEAMS cannot model the fate of the chemical within buffer areas, BLM took a conservative approach and assumed that the concentration of esfenvalerate leaving the fields was the amount entering the streams at the point of LCR and presence. The predicted concentrations of chemicals leaving the fields may be significantly lower than predicted in the risk assessments since any benefit from the riparian buffers has not been considered. In addition, there would likely be significant settling, mixing, and dilution beyond that modeled as a result of instream transport from the stream entry point to the habitat.

The potential for effects to steelhead is based on the modeled expected exposure concentrations (EEC) of esfenvalerate in the water in Clear Creek, at the confluence with Swagger Creek. Steelhead are not known to use any of the tributaries of Clear Creek that enter the seed orchard. Two concentrations were evaluated. The first is the concentration in Clear Creek during mid-winter since this is the most likely time that peak concentrations of esfenvalerate might enter the streams, according to the GLEAMS model. The concentrations are based on the peak winter concentration of esfenvalerate leaving the treatment fields diluted by the estimated mean winter flows in Clear Creek. These EEC's were compared to the LC_{50} (0.3 mu g/L) for rainbow trout (EXTOXNET). The second concentration evaluated is based on the peak spring-time concentration of esfenvalerate leaving the treatment fields diluted by the estimated mean spring flows in Clear Creek. The spring-time exposure concentration was used to estimate the concentration that may be in the water when eggs may be in the gravel. The spring-time EEC's were compared to the LC_{50} values for rainbow trout and the LC_{50} (0.09 mu g/L) for 6-day steelhead embryos/fry (Curtis, et al. 1985).

To assess the potential for adverse affects to LCR, the BLM used a two-step environmental risk analysis. The first step utilized the risk assessment procedure outlined by the EPA for endangered species (EPA 1986). In this process, the EEC is compared to an effect level (e.g., an LC_{50}) based on regulatory risk criteria for acute toxicity established by the EPA, U.S. Fish and Wildlife Service and the National Marine Fisheries Service. The regulatory risk criteria for

ESA-listed aquatic organisms makes a "presumption of unacceptable risk" if the EEC is greater than 1/20 LC_{50}. It is reasonable to equate the EPA's "presumption of unacceptable risk" to "possible adverse effects" (Ted Buerger, personal communication on March 19, 2001). The regulatory criteria does not assign any level of risk when the EEC is less than 1/20 LC_{50}. For this analysis, the BLM used the EEC values, derived from the "edge of field" results of the GLEAMS model, during maximum winter flows and maximum spring flows, as described above. The results of this assessment for steelhead are shown in Table 3. This is considered to be a conservative assessment because the concentrations of esfenvalerate predicted in the modeling are likely to be significantly higher than any actual stream concentrations (if any) that may result from implementation of the proposed action.

The second step of the risk assessment brought into consideration the on-site conditions which were not considered in step 1 due to limitations of the GLEAMS model. The primary factors considered are the existence of well vegetated riparian buffers and whether or not there is a hydrologic connection between the treatment areas and the nearby streams. This part of the assessment is subjective in nature, since no EEC values could be developed.

It is not expected that there will be any adverse effects to steelhead in either Clear Creek or Milk Creek as a result of the proposed application of esfenvalerate in the seed orchard (Table 3). The modeled EEC's in both Clear Creek and Milk Creek are less than the 1/20 LC_{50} value (actually less than 1/100 of the LC_{50} value) for all life stages. The predicted EEC's in Clear Creek are based on the combined "edge of field" concentrations for all treated units in the Swagger Creek drainage. Actual concentrations in Clear Creek are expected to be much lower due to on-site conditions, such as riparian buffers, which should minimize, or prevent, any esfenvalerate from entering the streams. There is a moderate potential for contamination only to streams 2 and 3 (tributaries to Swagger Creek). Any potential chemical runoff from the units, including stream 2, is expected to go subsurface and be adsorbed to the soil and is not expected to reach flowing streams. Surface water runoff monitoring in 2001 found that stream 3 does have ephemeral flow in unit P-13 and could be a source for chemical contamination downstream. However, monitoring of chemical runoff in stream 3 found no detectable levels of esfenvalerate.

Monitoring by the BLM in 2001 indicated that there is a potential for contamination of orchard streams flowing into Clear Creek from either chemical drift or drip during actual spray application. Analysis of the concentrations of esfenvalerate found in the streams resulting from drift or drip indicate that extremely low concentrations of the chemical could potentially reach Clear Creek. The estimated 24 hour concentration in Clear Creek was 1000 times lower than the 1/20 LC50 value for trout fry. It is possible that no esfenvalerate ever actually reached Clear Creek as the chemical has a high propensity to absorb to organic matter. New design criteria to be implemented in 2002 (see Section 1.2.1 above) are expected to further minimize the potential for drift or drip contamination.

It is expected that implementation of project conservation measures as described above in Section 1.2.1 would greatly minimize the risk that esfenvalerate would reach downstream LCR steelhead populations in concentrations sufficient to elicit significant sublethal and less likely lethal effects. Application buffers and drift monitoring should avoid drift contamination. Vegetated buffer strips and soil aeration should maximize infiltration rates and minimize over-ground flow. The soils should contain the pesticides until biodegradation and half-living renders the chemicals impotent. The vigorous grass cover should prevent erosion.

While risk assessment estimates indicate the project may slightly alter the existing water quality, conservation measures should adequately minimize short-term and avoid long-term adverse affects to LCR steelhead.

Table 4. Modeled expected exposure concentrations of Asana XL (Esfenvalerate) for steelhead and steelhead embryos/fry in Clear Creek and Milk Creek for 2002 Horning Seed Orchard spray project.

Species/Life Stage	**LC_{50} (ppb)**	**1/20 LC_{50} (ppb)**	**EEC (ppb)***	**Flow Condition for EEC**	**Is EEC > 1/20 LC50?**
			Clear Creek		
Steelhead (rainbow trout)	0.3	0.015	0.00009	winter maximum flow	no
			0.00026	spring maximum flow	no
Steelhead embryos/fry	0.09	0.0045	0.00026	spring maximum flow	no
			Milk Creek		
Steelhead (rainbow trout)	0.3	0.015	0.00014	winter maximum flow	no
			0.00038	spring maximum flow	no
Steelhead embryos/fry	0.09	0.0045	0.00038	spring maximum flow	no

*EEC = Expected Exposure Concentration ppb = parts per billion

1.5.3. Effects on Critical Habitat

NMFS designates critical habitat based on physical and biological features that are essential to the listed species. Essential features of designated critical habitat include substrate, water quality, water quantity, water temperature, food, riparian vegetation, access, water velocity, space and safe passage. The proposed treatment area would not occur within designated critical habitat for LCR steelhead, but the action area may extend into critical habitat because rain events could transport insecticides offsite and downstream.

Based on risk assessment probabilities, water quality impairment could result from upslope application of esfenvalerate. For esfenvalerate, contaminated sediment could settle in stream pools or the interstitial spaces of gravels and be a contaminant source for months. Impairment of the water quality may significantly affect aquatic invertebrates within LCR steelhead habitat and thereby impact their prey base. The literature suggests invertebrate reductions could persist for a period of weeks (Smith and Stratton 1986), months, or even years following exposure to insecticides (Spence *et al.* 1996). Spence *et al.* (1996) state "the greatest effect of insecticide on fish probably arises from effects on terrestrial and aquatic insects that form the salmonids' food base."

While risk assessment estimates indicate the project may slightly alter the existing water quality and potentially the prey base of LCR steelhead habitat, conservation measures should adequately minimize short-term and avoid long-term adverse modification of critical habitat.

1.5.4. Cumulative Effects

Cumulative effects are defined in 50 CFR 402.02 as those effects of "future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation." Future Federal actions, including the ongoing operation of hydropower systems, hatcheries, fisheries, and land management activities are being (or have been) reviewed through separate section 7 consultation processes. Therefore, these actions are not considered cumulative to the proposed action. The Federal government administers approximately 6 percent of the land in the Clear Creek drainage.

NMFS is not aware of any specific future non-Federal activities within the action area that would cause greater impacts to listed species than presently occurs. However, the adjacent lands are in private timber production. The use of chemical fertilizers, herbicides, or pesticides as part of normal forest practice may occur, but no specific information is known regarding their use. Furthermore, NMFS does not consider the regulations governing timber harvests on non-Federal lands within Oregon to be sufficiently protective of stream and riparian habitat values. Therefore, the possibility exists that those habitat values are at risk by future harvests on non-Federal lands within the basin.

1.6. Conclusion

After reviewing the current status of LCR steelhead, the environmental baseline for the action areas, the effects of the proposed insecticide application and the cumulative effects, NMFS has determined that the proposed esfenvalerate insecticide application, as proposed, at the Horning Seed Orchard is not likely to jeopardize the continued existence of the LCR steelhead, and is not likely to destroy or adversely modify designated critical habitat. This finding is based, in part, on incorporation of conservation measures into the proposed project design, including concurrent monitoring of drift during application periods. Furthermore, NMFS expects implementation of the monitoring plan as a whole to provide better information about the potential for offsite transport of contaminants.

In summary, our conclusion is based on the following considerations: 1) The proposed action will occur approximately 1.1 upstream of the designated LCR steelhead critical habitat; 2) LCR steelhead do not occur within the treatment area; 3) 200-foot minimum no-spray buffers will be used around all perennial, intermittent, or surface waters present at the time of application; 4) wind limits and drift monitoring concurrent with insecticide application will minimize the risk of direct contamination of area waterways, including the halting of activities if drift is observed 60 feet from any treatment area; 5) precipitation forecast limits, soil aeration, silt fences, and sand traps will minimize the risk of indirect water contamination via ground transport; 6) vigorous ground cover will minimize risk of erosion and contaminated sediment transport; 7) staging areas are located well away from water on ridgetops; 8) esfenvalerate binds strongly with soils and is not water soluble; 9) esfenvalerate is broken down by sunlight and microorganisms; 10) inert ingredients are volatile and will not be available to enter waterways; 11) no new roads or vegetation removal are proposed; and 12) existing natural riparian buffers are present to assist in the protection of downslope water quality.

The proposed esfenvalerate insecticide application appears to possess the potential to expose LCR steelhead to sub-lethal (less than 1/100 of LC_{50} value for embryos, fry, or fingerlings) concentrations of esfenvalerate, may have significant detrimental impacts on prey species (aquatic invertebrates). And significant esfenvalerate concentrations could persist until the next wet season thereby providing a continuing source of contamination. Therefore, NMFS believes that non-lethal incidental take of LCR steelhead is reasonably certain to result. Our conclusion is based on the finding that esfenvalerate elicits sub-lethal effects at extremely low concentrations and modeling indicates esfenvalerate concentrations leaving the treatment units may exceed those concentrations.

1.7. Conservation Recommendations

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Conservation recommendations are *discretionary* measures suggested to minimize or avoid adverse effects of a proposed action on listed species, to minimize or avoid adverse modification of critical habitat, or to develop additional information.

The NMFS recommends that: 1) The wind limit for spraying be reduced to 3 miles per hour, and 2) spraying within 400 feet of any waterway be limited to periods of calm winds only.

In order for NMFS to be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, NMFS request notification of the implementation of any conservation recommendations.

1.8 Reinitiation of Consultation

This concludes formal consultation under the ESA on this action in accordance with 50 CFR 402.14(b)(1). Reinitiation of consultation is required: 1) If the amount or extent of incidental take is exceeded, 2) the action is modified in a way that causes an effect on the listed species that was not previously considered in the biological assessment and this Opinion, 3) new information or project monitoring reveals effects of the action that may affect the listed species in a way not previously considered, or 4) a new species is listed or critical habitat is designated that may be affected by the action (50 CFR 402.16).

2. INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and Federal regulation pursuant to section 4(d) of the ESA prohibit the take of endangered species and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect, or attempt to engage in any such conduct. Harm is further defined by NMFS to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, and sheltering. Harass is defined by NMFS as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly alter normal behavior patterns which include, but are not limited to, breeding, feeding, and sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of Section 7(b)(4) and Section 7(o)(2), taking that is incidental to, and not intended as part of, the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the term and conditions of this Incidental Take Statement.

2.1. Amount or Extent of Take

NMFS anticipates that the proposed action covered by this Opinion is reasonably certain to result in non-lethal incidental take of juvenile LCR steelhead due to sublethal behavior modifications as a result of potential exposure to esfenvalerate. Effects of actions such as these are largely unquantifiable in the short term. The effects of these activities on population levels are also largely unquantifiable and not expected to be measurable in the long term.

Therefore, even though NMFS expects some low level of incidental take may occur due to the action covered by this Opinion, the best scientific and commercial data available are not sufficient to enable NMFS to estimate a specific amount of incidental take to the species itself. In instances such as this, NMFS designates the expected level of take in terms of the extent of take allowed. Therefore, NMFS limits the area of allowable incidental take for LCR steelhead to all reaches of Clear Creek tributaries within the Horning Seed Orchard and downstream to Clear Creek and Clear Creek downstream to its mouth for a period of six months following application. Incidental take occurring beyond these areas (i.e., Clackamas River) or time limit is not authorized by this consultation. Based on the information provided, NMFS anticipates that an unquantifiable but low level of incidental take could occur as a result of the action covered by this Opinion. Moreover, the small amount of take that may occur is expected to be non-lethal.

2.2. Reasonable and Prudent Measures

NMFS believes that the following reasonable and prudent measures are necessary and appropriate to minimize take of LCR steelhead. Minimizing the amount and extent of take is essential to avoid jeopardy to the listed species.

1. Minimize the likelihood of incidental take associated with insecticide application by implementing conservation measures.

2. Minimize the likelihood of incidental take by confirming that esfenvalerate is not detectable beyond the areas authorized by this consultation.

3. Monitor the effectiveness of the proposed conservation measures in minimizing incidental take and report to NMFS.

2.3. Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Act, BLM must comply with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions are non-discretionary.

1. To Implement Reasonable and Prudent Measure #1, the BLM shall:

    a. Implement all conservation measure described in the Proposed Action section of this Opinion, or gain prior authorization from NMFS to forgo implementation of any measure.

b. Review the provisions of this Opinion with the contracted applicator prior to commencing insecticide application operations.

c. Review Horning Seed Orchard's spill response plan with the contracted applicator prior to commencing insecticide application operations.

d. Notify NMFS (R. Lindland 503-231-2315) one week prior to commencing the initial insecticide application.

e. Allow NMFS to be present, at its discretion, during any insecticide application operation.

f. Ensure all chemical storage, chemical mixing, and post-application equipment cleaning is completed in such a manner as to prevent the potential contamination of any riparian area, perennial or intermittent waterway, unprotected ephemeral waterway, or wetland.

g. Halt all application operations whenever drift has been observed to exceed 59 feet from the treatment area (either visually-observed or indicated by drift card hits at 60 feet).

h. Do not recommence insecticide application following a drift instigated work stoppage until NMFS (R. Lindland 503-231-2315) has been notified, and environmental conditions and/or application technique have been sufficiently altered to prevent 60-foot drift.

i. Do not conduct insecticide application when precipitation is forecast to occur within 24 hours.

j. Apply a 200-foot no-spray buffer on any roadside ditches that may convey contaminents to waterways.

2. To implement Reasonable and Prudent Measure #2, the BLM shall:

a. Monitor the boundaries of the designated incidental take areas by implementing those pertinent actions detailed in the Effectiveness Monitoring section of the Water Quality Monitoring Plan (Appendix A). NMFS will accept a negative upstream sample (no detectable esfenvalerate in Streams 2b, 5a, and 6d nearest the application areas) as proof that no esfenvalerate is present further downstream or in Clear Creek, and as sufficient demonstration of compliance with this Term and Condition.

3. To implement Reasonable and Prudent Measure #3, the BLM shall:

   a. Implement the Water Quality Monitoring Plan as presented to NMFS during consultation (Appendix A).

   b. Continue monitoring runoff for a minimum of six months following insecticide application (the period identified by BLM as having the highest probability of aquatic resource contamination due to runoff).

   c. Notify NMFS (R. Lindland 503-231-2315) of any significant deviation from the Water Quality Monitoring Plan (Appendix A).

   d. Following the completion of insecticide application and monitoring, provide NMFS with a summary report by December 31, 2002, describing the success of conservation measures required under Reasonable and Prudent Measure #1, and the results of monitoring under Reasonable and Prudent Measure #2 and #3(a). The report should focus on actions taken to ensure that esfenvalerate was contained to the treatment area to the greatest extent possible. It is recommended that the report include photo documentation.

   e. Monitoring reports shall be submitted to:

      National Marine Fisheries Service
      Attn: Ron Lindland
      Re: OSB2001-0034
      525 NE Oregon Street, #500
      Portland, Oregon 97232-2778

   f. If a dead, sick or injured LCR steelhead is located, immediate notification must be made to Ron Lindland, NMFS, at 503.231.2315, or NMFS Law Enforcement at 360.418.4246. Care will be taken in handling sick or injured specimens to ensure effective treatment and care or the handling of dead specimens to preserve biological material in the best possible state for later analysis of cause of death. In conjunction with the care of sick or injured species or preservation of biological material from a dead animal, the finder has the responsibility to carry out instruction provided by Law Enforcement to ensure that evidence intrinsic to the specimen is not unnecessarily disturbed.

3. MAGNUSON-STEVENS ACT

3.1 Background

The objective of the essential fish habitat (EFH) consultation is to determine whether the proposed action may adversely affect designated EFH for relevant species, and to recommend conservation measures to avoid, minimize, or otherwise offset potential adverse effects to EFH resulting from the proposed action.

3.2 Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Fishery Conservation and Management Act (MSA), as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-297), requires the inclusion of EFH descriptions in Federal fishery management plans. In addition, the MSA requires Federal agencies to consult with NMFS on activities that may adversely affect EFH.

EFH means those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity (MSA §3). For the purpose of interpreting the definition of essential fish habitat: Waters include aquatic areas and their associated physical, chemical, and biological properties that are used by fish and may include aquatic areas historically used by fish where appropriate; substrate includes sediment, hard bottom, structures underlying the waters, and associated biological communities; necessary means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" covers a species' full life cycle (50CFR600.110).

Section 305(b) of the MSA (16 U.S.C. 1855(b)) requires that:

- Federal agencies must consult with NMFS on all actions, or proposed actions, authorized, funded, or undertaken by the agency, that may adversely affect EFH.
- NMFS shall provide conservation recommendations for any Federal or State activity that may adversely affect EFH.
- Federal agencies shall within 30 days after receiving conservation recommendations from NMFS provide a detailed response in writing to NMFS regarding the conservation recommendations. The response shall include a description of measures proposed by the agency for avoiding, mitigating, or offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with the conservation recommendations of NMFS, the Federal agency shall explain its reasons for not following the recommendations.

The MSA requires consultation for all actions that may adversely affect EFH, and does not distinguish between actions within EFH and actions outside EFH. Any reasonable attempt to encourage the conservation of EFH must take into account actions that occur outside EFH, such as upstream and upslope activities, that may have an adverse effect on EFH. Therefore, EFH consultation with NMFS is required by Federal agencies undertaking, permitting or funding activities that may adversely affect EFH, regardless of its location.

3.3 Identification of EFH

The Pacific Fisheries Management Council (PFMC) has designated EFH for federally-managed fisheries within the waters of Washington, Oregon, and California. The designated EFH for groundfish and coastal pelagic species encompasses all waters from the mean high water line, and upriver extent of saltwater intrusion in river mouths, along the coasts of Washington, Oregon and California, seaward to the boundary of the U.S. exclusive economic zone (370.4 km)(PFMC 1998a, 1998b). Freshwater EFH for Pacific salmon includes all those streams, lakes, ponds, wetlands, and other water bodies currently, or historically accessible to salmon in Washington, Oregon, Idaho, and California, except areas upstream of certain impassable man-made barriers (as identified by the PFMC), and longstanding, naturally-impassable barriers (i.e., natural waterfalls in existence for several hundred years)(PFMC 1999). In estuarine and marine areas, designated salmon EFH extends from the nearshore and tidal submerged environments within state territorial waters out to the full extent of the exclusive economic zone (370.4 km) offshore of Washington, Oregon, and California north of Point Conception to the Canadian border.

Detailed descriptions and identifications of EFH for salmon are found in Appendix A to Amendment 14 to the Pacific Coast Salmon Plan (PFMC 1999). Assessment of the potential adverse effects to these species' EFH from the proposed action is based on this information.

3.4 Proposed Action

The proposed action is detailed above in section 1.2. Clear Creek is within designated EFH for coho salmon and chinook salmon.

3.5 Effects of Proposed Action

The effects of the proposed action are described in detail in section 1.5. Because the known distribution of coho salmon within the Clear Creek drainage is similar to the known distribution of LCR steelhead in that drainage, the proposed action may adversely affect coho salmon EFH. However, since chinook salmon occur in Clear Creek approximately 12 miles downstream from the project site, the project is not expected to adversely affect chinook salmon EFH.

3.6 Conclusion

NMFS believes that the proposed action may adversely affect EFH for coho salmon in Clear Creek.

3.7 EFH Conservation Recommendations

Pursuant to section 305(b)(4)(A) of the Magnuson-Stevens Act, NMFS is required to provide EFH conservation recommendations for any Federal or State agency action that would adversely affect EFH. The conservation measures proposed for the project by the BLM and all of the reasonable and prudent measures and the terms and conditions contained in Sections 2.2 and 2.3 are applicable to EFH. Therefore, NMFS incorporates each of those measures here as EFH conservation recommendations.

3.8 Statutory Response Requirement

Please note that the Magnuson-Stevens Act (section 305(b)) and 50 CFR 600.920(j) requires the Federal agency to provide a written response to NMFS after receiving EFH conservation recommendations within 30 days of its receipt of this letter. This response must include a description of measures proposed by the agency to avoid, minimize, mitigate or offset the adverse impacts of the activity on EFH. If the response is inconsistent with a conservation recommendation from NMFS, the agency must explain its reasons for not following the recommendation.

3.9 Consultation Renewal

The BLM must reinitiate EFH consultation with NMFS if the action is substantially revised or new information becomes available that affects the basis for NMFS' EFH conservation recommendations (50 CFR 600.920).

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APPENDIX A

BLM's Proposed Monitoring Plan

Goal

The goal of this plan is to determine if implementation of the 2002 Horning Seed Orchard spray plan results in the short term presence of esfenvalerate in streams due to drift / drip and the presence of esfenvalerate due to runoff. This data will be utilized in discussing effects and further long term monitoring in future Environmental Assessments.

Background

Agencies and the public are concerned that pesticide application in the Horning seed Orchard may be harmful to fish, contributing to concentrations in streams which exceed those known to have effects on aquatic life. Several mitigation measures have been added to the 2002 Spray EA to minimize the potential affects to water quality from spills, drift, or runoff. Monitoring of these transport mechanisms and the impacts are part of the design features. The water quality monitoring required by this plan is focused on pesticide **drift and surface runoff** from the proposed application fields. Pesticide spill and the associated monitoring is outlined in the Pesticide Application Project - Safety Plan.

This plan covers two types of monitoring: **Compliance (implementation) monitoring and effectiveness monitoring.** The compliance monitoring is intended to document the design features and mitigation measures which are actually implemented. The effectiveness component documents how well the design features performed in avoiding introduction of esfenvalerate to the aquatic system.

Specific Objectives

1. Does drift of the aerial spray application occur?

   <u>Strategy</u>: Monitor all esfenvalerate applications to ensure ***<u>compliance</u>*** with mitigation measures and to document application rates, environmental conditions and the actual occurrence of drift.

2. Does aerial application of esfenvalerate result in measureable concentrations in the streams associated with the applied fields?

   <u>Strategy</u>: Conduct ***<u>effectiveness monitoring</u>*** for esfenvalerate applications to ensure that mitigation measures were effective in preventing drift and runoff from entering surface water. .

Compliance Monitoring

All esfenvalerate applications will be observed and documented by the orchard manager or designated representative. Items to be documented include: Type of pesticide applied, date of application, method of application, area treated, amount applied, precipitation for the three days preceding and following application, location used for mixing and loading, wind direction and speed for aerial or air blast applications, relative humidity, air temperature, and notes regarding whether any leakage or spills occurred..

Based on site observations during the application, all water related design features will be addressed for implementation compliance and documented in a FY 2002 Implementation Monitoring Report. A summary of the results will also be included in the Annual Implementation Monitoring Summary. As part of the whole monitoring plan, a climate station (including air temperature, precipitation, wind speed, wind direction and relative humidity) will be operated at the orchard facility. This will provide further record of compliance documentation .

Effectiveness Monitoring

DRIFT CARDS:

All orchard units planned for aerial spray will have spray cards placed such that drift from the application can be captured and characterized. Where the unit is in direct proximity to a water body (ex. Unit P-12 and Stream 2b) cards will be placed at approximately 50 feet apart along the edge of the unit prior to the application. Drift cards will be placed along the edge and within the immediate interior of the vegetative buffers on Units P-11, P-35 and P-36. Spray cards will also be placed at strategic locations along the helicopter crossing corridor over stream 6.

Map A shows the recommended zones for drift card placement. Immediately after the application, the cards will be collected and reviewed to determine if any drift has occurred, the extent of the drift, and the potential for contamination of the adjacent water bodies. A copy of all the cards will be kept on file along with a record of their location, a record of water quality monitoring results, and all the compliance monitoring documentation.

WATER SAMPLES FOR DRIFT MONITORING:

Water samples will be taken in Stream 2b , 5a and 6d **prior to and post** spray application (See **Map B** of sample sites). These streams are the closest to the application areas and contain the highest risk of drift transport. Samples will be taken within 24 hours prior to application and at 15 minutes, 2 hours, 4 hours, 8 hours and 24 hours after the first swath has been sprayed near the buffer strip (as per ODF, 1994). The time of collection will be based on the travel time of water movement in the flowing channels associated with the treatment areas. Flow velocity measurements will be taken during the 24 hours prior to application in order to calculate travel time. During the 24 hours after application, a series of composite samples will also be taken at Stream 2b (highest risk) through the use of a continuous pumping sampler. This data will provide a 24-hour concentration to compare with the ODF protocol methods. All data will be recorded on forms presented in **appendix A.**

A prior and post application water sample will be taken in the “Thompson” spring area located the SWSW Section 23. This is associated with the spray project planned in Orchard Unit P-30 and P-33. The monitoring site will be located in the surface wetland associated with the spring catchment area on BLM land. The “prior” sample will be taken within 24 hours prior to the application. The post sample will occur two hours after the application. This should offer sufficient time for any potential drift to the wetland to have occurred.

All data will be used in conjunction with the spray cards to illustrate the effectiveness of mitigating potential drift and drip introduction. Samples will be analyzed at a State certified laboratory that has detection limits of .02 ppb for esfenvalerate. Samples will be collected in accordance with laboratory instructions.

WATER SAMPLES for Runoff Monitoring:

In terms of the EA impact analysis (GLEAMS modeling results), potential runoff events which occur within the first 6 months after spray application have the highest probability for carrying concentrations which could impact aquatic life. One study (Rashin and Graver,1993) determined that runoff events within the first 72 hours of application were the most important in terms of increases in detectible concentrations in ppb. This monitoring plan will target those periods of precipitation which result in field surface runoff and increased stream flow which are most likely to carry the greatest concentrations. The effectiveness of design features such as increased aeration, wide untreated buffer strips and erosion control will be assessed through monitoring field runoff and streamflow concentrations.

Field runoff samples will be captured at the edge of orchard units P-11 and P-12 (**see map B)**. These units will have stainless steel collection chambers and discharge flumes installed at the low point of the downslope edge of the field. During rainfall events which result in surface runoff, these sites will be sampled throughout the runoff period. Total volume of runoff for the event will also be recorded. Once the first runoff event is captured and results become available, further sampling will be determined as needed.

Sampling of stream flow will occur in Stream 2b (**see map B**) due to the channel connectivity to proposed spray unit P-12. This station will collect samples on a flow activated basis using a continuous pumping sampler and a stage recording device. The sampler will be activated on any increase in stream flow from the baseline pre-application flows during a period of 72 hours after application. After this time, only streamflow samples which are associated with field runoff events will be analyzed. The intention is to provide comparison between edge of field concentrations and in stream concentrations.

All data will be used in conjunction with on- site climate data to illustrate the effectiveness of design features in minimizing introduction of esfenvalerate to the aquatic system**.** Samples will be analyzed at a State certified laboratory that has detection limits of .02 ppb for esfenvalerate. Samples will be collected in accordance with laboratory instructions including holding times.

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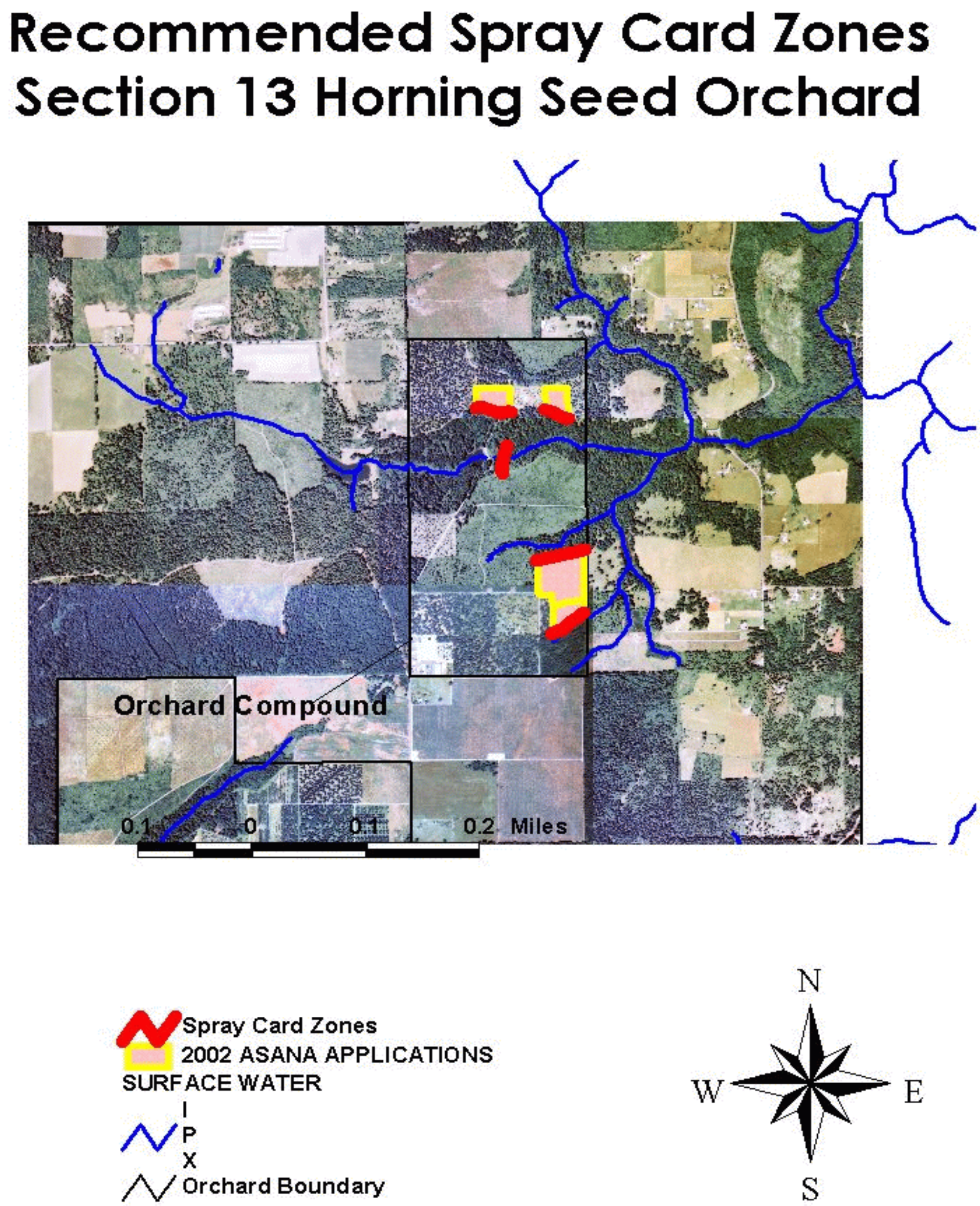
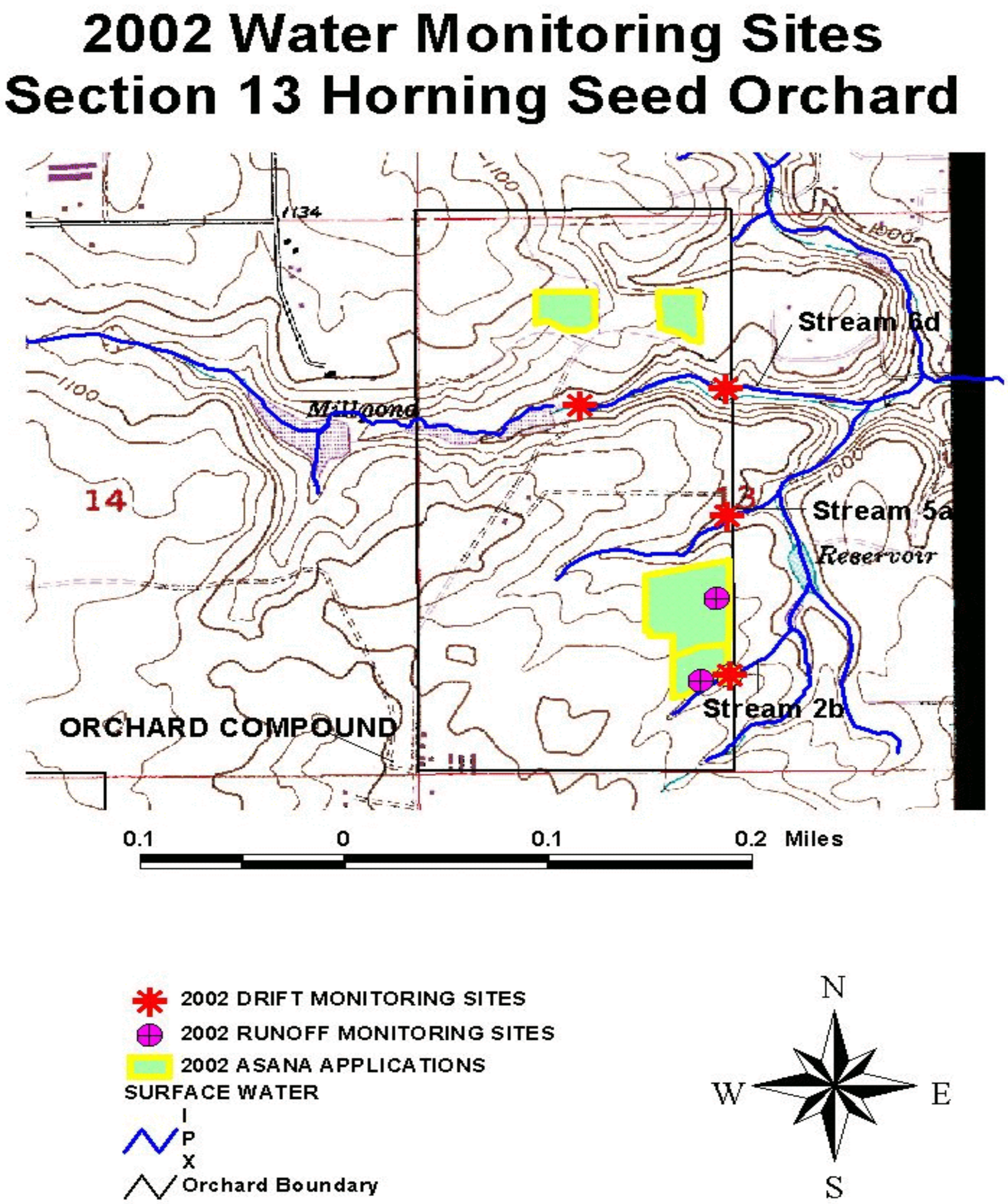
Map A: Recommended Spray Card Placement Zones



Map B: Monitoring Sites



Appendix A : Water Quality Sampling Form (Modified ODF)

Water Quality Monitoring Data Form: Drift Monitoring
Walter Horning Seed Orchard : Spring Asana Spray Project

Stream Name:____

Site Number: ____

Average Stream velocity (v): ______________ (ft/sec)

Spray Start Date/Time:______________________

15 minute Sample time:________________minutes from spray start.

Sample Description	Sample Collection Date	Sample Collection Time	Sample ID #	Sampler Name
Control Sample				
15 minute				
2 hour				
4 hour				
8 hour				
24 hour				

Comments: (ex sampling conditions):

____

Background WQ conditions:

pH	
Specific Conductance	
Turbidity	